

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2004-302067

(43)Date of publication of application : 28.10.2004

(51)Int.Cl.

G02B 6/00
F21V 8/00
G02F 1/13357
// F21Y103:00

(21)Application number : 2003-094217

(71)Applicant : TOYOTA INDUSTRIES CORP

(22)Date of filing : 31.03.2003

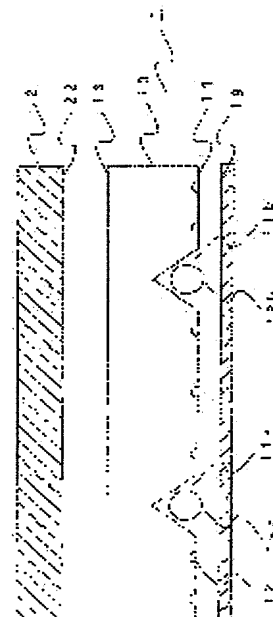
(72)Inventor : NIIDA HIDENORI
ISOTANI BUNICHI
MITA YASUCHIKA
TAKEUCHI NORIHITO
KOIKE HIDEJI
FURUNOMA TAKAAKI
IIDA SATORU

(54) LIGHT GUIDE PLATE, LIGHTING DEVICE, AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a light guide plate capable of realizing uniform and high brightness over the whole light exiting surface, being made thinner, realizing sufficient strength and uniformity of brightness, and being substantially used for a large type lighting device, to provide an easy-to-manufacture lighting device using the light guide plate, and to provide a liquid crystal display device equipped with the device as back-light.

SOLUTION: In the light guide plate, one or more grooves 11 for light source arrangement are formed on the rear surface 14 of the light emitting surface 13. Each of the grooves 11 is provided with a light guide plate 10 consisting of only the planes oblique to the light emitting surface 13.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision
of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]

It is the light guide plate with which one or more slots for light source arrangement were formed in the tooth back of an optical outgoing radiation side,

Said slot for light source arrangement is a light guide plate characterized by consisting only of a flat surface which inclined to said optical outgoing radiation side.

[Claim 2]

At least one of said flat surfaces is the light guide plate according to claim 1 characterized by being the include angle of 40 or less degrees 25 degrees or more to the normal of an optical outgoing radiation side.

[Claim 3]

Said flat surface is a light guide plate according to claim 1 characterized by being the include angle of 40 or less degrees 25 degrees or more to the normal of an optical outgoing radiation side, respectively.

[Claim 4]

A light guide plate given in any 1 term of claims 1-3 characterized by the distance of a tooth back and an optical outgoing radiation side being short as said end face is approached rather than said slot for light source arrangement at least by the part among the fields between the slot for light source arrangement, and the end face of a light guide plate.

[Claim 5]

A light guide plate given in any 1 term of claims 1-4 characterized by the distance of a tooth back and an optical outgoing radiation side being short as the location of the arbitration between one slot and the slot on another side is approached at least by the part among [slot / each] the fields between the slot for light source arrangement on 1, and other slots for light source arrangement.

[Claim 6]

A light guide plate given in any 1 term of claims 1-5 characterized by establishing a lighting means further.

[Claim 7]

A light guide plate given in any 1 term of claims 1-6 characterized by beveling at least one angle between the flat surfaces which constitute said slot for light source arrangement.

[Claim 8]

A light guide plate given in any 1 term of claims 1-7,

The light source arranged in the slot for light source arrangement of said light guide plate,

Preparation *****.

[Claim 9]

A lighting system according to claim 8,

The liquid crystal display component arranged at the optical outgoing radiation side side of said light guide plate,

Preparation *****.

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the lighting system equipped with the light guide plate with which one or more slots for light source arrangement were formed in the tooth back of an optical outgoing radiation side, and the light guide plate concerned, and the liquid crystal display equipped with the lighting system concerned as the back light source.

[0002]

[Description of the Prior Art]

Conventionally, it has a liquid crystal display component (liquid crystal display panel) and a lighting system (the back light source, back light), and the liquid crystal display which displays an image because a liquid crystal display component adjusts the amount of transparency of the light irradiated from the lighting system is known. in order that the lighting system used for this liquid crystal display may give an indication legible -- the whole liquid crystal display component surface -- crossing -- uniform (there being no brightness unevenness) -- and -- high -- it is required that a brightness light should be supplied. Generally as a lighting system, the lighting system of an edge light method and the lighting system of direct female mold are adopted.

[0003]

The cross-sectional view for explaining the structure of the lighting system of an edge light method to drawing 23 is shown. The lighting system 7 of the edge light method shown in drawing 23 is equipped with a light guide plate 70, a reflecting plate 71, and the cold cathode fluorescent lamp (light source) 72. Generally, the so-called wedge light guide plate with which the distance of the optical outgoing radiation side 74 and the tooth back 75 of the field concerned approaches gradually (thickness decreases) is adopted, and two or more formation of the dispersion dot 76 as a lighting means is carried out in a tooth back 75 as a light guide plate 70 keeps away from the optical plane of incidence 73.

Since the lighting system of an edge light method is equipped with the above configuration, there is little brightness unevenness. This is explained below.

[0004]

Since the light which carried out incidence to the light guide plate 70 from the cold cathode fluorescent lamp 72 is scattered about by the dispersion dot 76 and incidence of a part of scattered light is carried out to the optical outgoing radiation side 74 at an include angle smaller than a critical angle, it is taken out in the light guide plate 70 exterior (inside m1 of drawing). Since incidence of other light m2 is carried out to the optical outgoing radiation side 74 side at a larger include angle than a critical angle, total reflection of them is carried out by the optical outgoing radiation side 74 to a tooth-back 75 side. And the light which reached to the tooth back 75 is reflected by the dispersion dot 76 at an include angle with a part smaller than the critical angle of the optical outgoing radiation side 74, it is taken out in the light guide plate 70 exterior (inside m3 of drawing), and others progress the inside of a light guide plate 70 further (inside m4 of drawing). It repeats that henceforth takes out a part of light from an optical outgoing radiation side to the light guide plate exterior, and carries out total reflection of the others similarly.

By using a light guide plate 70 as mentioned above, since light is taken out from any location in the optical outgoing radiation side 74, there is almost no problem of the brightness unevenness that the brightness of an about 72 cold cathode fluorescent lamp [in the optical outgoing radiation side 74] location will become high compared with other locations, it crosses all over optical outgoing radiation side 74, and the brightness of homogeneity is obtained mostly.

[0005]

In addition, on these specifications, it writes advancing light as mentioned above into a light guide plate as "A light guide is carried out" suitably.

[0006]

However, there is a problem that a limitation is in the brightness obtained in the lighting system of an edge light method, and this problem is serious in the lighting system used for a large-sized liquid crystal display (for example, 20 inches or more) etc.

Since the arrangement location of the light source in an edge light method is a light guide plate end face, and the number of the light sources which can be arranged will be limited, the above-mentioned problem is produced. As generally shown in drawing 24 , since the rectangular light guide plate 70 is adopted, an optical outgoing radiation side can arrange light source 72a, and b, c and d only in the location which counters four end-faces 73a, and b, c and d at the maximum.

That is, since the number of the light sources which can be used will be restricted, the brightness obtained with a lighting system 7 will be limited.

[0007]

Moreover, since outgoing radiation of the part is serially carried out in the light guide plate exterior as it described above, when carrying out the light guide of the inside of a light guide plate, the light by which incidence was carried out to the light guide plate from the light source does not fully arrive even at a location distant from the light source in a light guide plate.

Therefore, the light of amount sufficient in a large-sized lighting system even for the location (the example of drawing 24 light guide plate 70 center section) distant from the light source did not arrive, but there was what (brightness unevenness will arise) a uniform light is not obtained for.

[0008]

On the other hand, the light sources 81, such as 1 or two or more LED, are formed in the tooth back (inside of an effective viewing area) of the liquid crystal display component 80, and the lighting system of direct female mold is equipped with a reflecting plate 82 behind the light source 81, as shown in drawing 25 .

Therefore, the lighting system of direct female mold has the high degree of freedom of the number of the light sources which can be arranged rather than the lighting system of an edge light method, and if the number of the light sources is chosen suitably, it can obtain required brightness. That is, compared with the lighting system of a side edge mold, brightness can be made high, and it can use also as a large-sized lighting system.

[0009]

However, in the lighting system of direct female mold, since direct incidence of the light from the light source is carried out to a liquid crystal display component, the light by which incidence is carried out to the location of the abbreviation right above of the light source in a liquid crystal display component increases more than the light by which incidence is carried out to other locations, and has the trouble that brightness unevenness will occur.

[0010]

then, the whole surface -- crossing -- homogeneity -- high -- it considers as the lighting system which can carry out outgoing radiation of the brightness light, and the conventional technique using a light guide plate is proposed in the lighting system of direct female mold. For example, as shown in drawing 26 (a) and (b), two or more arrangement of the light guide plate 92 is carried out at the illuminated field (tooth back) 91 side of a display panel 90, and the first conventional technique about the lighting system which has arranged the arc tube 93 to the tooth-back side rather than the optical outgoing radiation side 94 between light guide plates 91 is also proposed (for example, patent reference 1 reference.).

According to the first conventional technique, from the light source (arc tube) 93 upper part,

direct outgoing radiation of the light which outgoing radiation is carried out from the light source, and does not carry out the light guide of the light guide plate 92 is carried out to the lighting-system exterior, and outgoing radiation of the light which carried out the light guide of the light guide plate 92 is carried out from the other location (optical outgoing radiation sides 94 other than the light source 93 upper part).

[0011]

Moreover, as shown in drawing 27, the second conventional technique about the liquid crystal display equipped with the light guide plate 100 with which the inclined plane 102 which has an internal reflection operation was established in the front face of a slot 101 top, the cold cathode fluorescence tubing 103 arranged in the slot 101 of a light guide plate 100, and the liquid crystal display component 104 installed in the front-face side of a light guide plate 100 is proposed. A light guide plate 100 consists of transparence plates of the abbreviation rectangle which performed light reflex processing 106 for avoiding total reflection at a tooth back 105, and one or more slots 101 which extend over two end faces to which a light guide plate 100 is parallel to the tooth back of the effective viewing area are formed (for example, patent reference 2 reference.).

According to the second conventional technique, in order to have an inclined plane 102, the light emitted from the cold cathode fluorescence tubing 103 which is the light source makes low the rate which carries out direct outgoing radiation to the lighting-system exterior from the light guide plate front face (a liquid crystal display component and field which counters) 107 (a light guide is not carried out). Moreover, the brightness in locations other than right above [cold cathode fluorescence tubing 103] in a light guide plate 100 is made high by carrying out the light guide of the light with a light guide plate 100.

[0012]

[Patent reference 1]

JP,2002-184231,A

[Patent reference 2]

JP,2001-133779,A

[0013]

[Problem(s) to be Solved by the Invention]

However, according to the first conventional technique, there are light (light by which a light guide is not carried out) m7 which passes also in the light which there are light m5 which does not pass a light guide plate, and passing light m6 as shown in drawing 26 (a), and passes a light guide plate, and light m6 by which a light guide is carried out. Therefore, the brightness of the abbreviation upper part of the part 93 to which outgoing radiation of the light m6 in which the light m5 which does not pass a light guide plate guides neither the part by which outgoing radiation is carried out, nor a light guide plate is carried out, i.e., a slot, will become high.

As shown in drawing 26 (b), even if it makes it the configuration which the optical outgoing radiation side 94 side of light guide plate 92 adjacent comrades meets with, the so-called bright line with which the brightness of the boundary location where light guide plate 92 comrades touch in the optical outgoing radiation side 94 becomes remarkably high compared with other locations will appear.

In addition, on these specifications, it writes suitably "the light which guided waves", and "the light by which the guided wave was carried out". [the thing of the light which arrives at locations other than the abbreviation right above section of the slot for light source arrangement] That is, there are "light by which the light guide was carried out", and "light which reached, without carrying out a light guide (** which is not once reflected within a light guide plate)" as "light which guided waves."

[0014]

Moreover, since the liquid crystal display by the first conventional technique is constituted by two or more light guide plates, the following problems may produce it.

- Compared with the liquid crystal display using the lighting system which consisted of light guide plates of one sheet, and this equipment, an assembly and arrangement become difficult.
- If the location of 1 or two or more light guide plates shifts from a design location, an optical

property will change with a design.

- In order to make it an installation location not shift, the special device of preparing the special frame for assembling the liquid crystal display by the first conventional technique will be needed separately.

[0015]

On the other hand, in order to establish an inclined plane 102 in the slot 101 upper part according to the second conventional technique, the thickness of the slot 101 upper part becomes very thin compared with the thickness of other parts, and its possibility of damaging is high. Moreover, in order to prevent that the brightness of the slot 101 upper part becomes remarkably high compared with the brightness of other locations, the light guide plate of a certain amount of thickness (generally 1mm or more) is required for the slot 101 upper part. Therefore, the light guide plate of the slot 101 upper part must be made to some extent thick. Thereby, the thickness 109 of a light guide plate 100 will turn into thickness which doubled the depth of a slot 101, the thickness 108 of a light guide plate, and the depth of a ramp 102, and a light guide plate and a lighting system will become thick compared with the light guide plate used with the first conventional technique, the light guide plate used by the edge light method. If another word is carried out and there will be no sufficient thickness, reinforcement sufficient as a product cannot be obtained, and it cannot cross all over an optical outgoing radiation side (effective viewing area), and uniform brightness cannot be obtained.

[0016]

the manufacture using the light guide plate which this invention is made in view of the above-mentioned trouble, it crosses all over an optical outgoing radiation side, and uniform and high brightness is obtained, sufficient reinforcement and brightness homogeneity are acquired even if thin-shape-izing is possible and it makes it thin, and can be substantially used also for a large-sized lighting system, and this -- it aims at offering an easy lighting system and the liquid crystal display equipped with this equipment as a back light.

[0017]

[Means for Solving the Problem]

In order to solve the above-mentioned technical problem, as for the light guide plate concerning this invention, one or more slots for light source arrangement are formed at the tooth back of an optical outgoing radiation side, and the slot for light source arrangement is characterized by consisting only of a slanting flat surface to an optical outgoing radiation side.

[0018]

The above-mentioned light guide plate is good for at least one of the flat surfaces which constitute the slot for light source arrangement to be constituted by the include angle of 40 or less degrees 25 degrees or more to the normal of an optical outgoing radiation side.

Furthermore, the above-mentioned light guide plate has them, when all the flat surfaces that constitute the slot for light source arrangement are constituted by the include angle of 40 or less degrees 25 degrees or more to the normal of an optical outgoing radiation side. [desirable]

[0019]

Among the fields between the slot for light source arrangement, and the end face of a light guide plate, in the at least 11 sections, the above-mentioned light guide plate is good for the distance of a tooth back and an optical outgoing radiation side to be short as it approaches an end face rather than the slot for light source arrangement.

Moreover, among the fields between the slots for light source arrangement, at least by the part, the distance of a tooth back and an optical outgoing radiation side may be short as "the location of the arbitration between one slot and the slot on another side" is approached rather than said slot for light source arrangement.

[0020]

The above-mentioned light guide plate is still better to establish the lighting means.

Moreover, at least one angle between the flat surfaces which constitute said slot for light source arrangement may be beveled.

[0021]

The lighting system concerning this invention is equipped with the above-mentioned light guide

plate and the light source, and is characterized by arranging the light source in the above-mentioned slot for light source arrangement.

[0022]

The liquid crystal display concerning this invention is characterized by arranging the above-mentioned lighting system as a back light at the tooth-back (non-display side) side of a liquid crystal display component.

[0023]

[Embodiment of the Invention]

The light guide plate and lighting system which explain and double the gestalt of operation of the liquid crystal display concerning this invention with a detail hereafter, and are applied to this invention are also explained to a detail.

[0024]

As shown in drawing 1, the liquid crystal display concerning the gestalt of this operation is equipped with a lighting system 1 and the liquid crystal display component 2 of a transparency mold, and the lighting system 1 is formed in the non-display side 22 side of the liquid crystal display component 2. That is, a lighting system 1 is the back light of the liquid crystal display component 2 of a transparency mold. A lighting system 1 is explained first.

[0025]

<<lighting-system 1>>

A lighting system 1 is equipped with a light guide plate 10, the cold cathode fluorescent lamps (light source) 18a and 18b, and the light reflex plate 19 as shown in drawing 1.

A light guide plate 10 has the optical outgoing radiation side 13, and it is arranged so that the optical outgoing radiation side 13 may counter the non-display side 22 of the liquid crystal display component 2. Two slots 11a and 11b for light source arrangement and two or more dispersion dots 12 as an optical ejection means are formed in tooth-back side (opposite side of optical outgoing radiation side 13) of optical outgoing radiation side 13 14.

The light sources 18a and 18b are arranged in slot 11 for light source arrangement a, and 11b, respectively.

The light reflex plate 19 is arranged at the light guide plate 10 and tooth-back side of the light sources 18a and 18b.

Hereafter, each component is further explained to a detail.

[0026]

The configuration of the slot 11 for <light-source arrangement> which consists of slanting flat surfaces to an optical outgoing radiation side

The top view of a light guide plate 10 is shown in drawing 2 (a), and a front view is shown in (b).

As shown in drawing 2 (a), the optical outgoing radiation side 13 of a light guide plate 10 is an abbreviation rectangle, and it is established so that it may extend to end-face 15c to which the slots 11a and 11b for light source arrangement counter tooth-back side 14 of the optical outgoing radiation side 13 from end-face 15b of 1 as shown in (a) and (b).

[0027]

two (slanting -- it is not parallel and perpendicular) flat-surfaces 11a- toward which the slots 11a and 11b (it is hereafter written as the slot 11 for light source arrangement suitably) for light source arrangement inclined to the optical outgoing radiation side 13, respectively -- 1 and 11 -- it consists of only a-2, flat-surface 11b-1, and 11b-2. Therefore, the cross-section configuration of the slot 11 for light source arrangement serves as a triangle, as shown in drawing 1.

[0028]

rather than the light guide plate with which the cross section configuration be equipped with the slot for light source arrangement of a rectangle or a hemicycle by the light guide plate 10 hereafter apply to the gestalt of this operation which consist only of a slanting flat surface to the optical outgoing radiation side 13 in this way, the brightness of locations other than the abbreviation right above section of the slot for light source arrangement in an optical outgoing radiation side be high, and a reason with little brightness unevenness be explain using drawing 3.

[0029]

Drawing 3 (a) The slot for light source arrangement shown in - (c) is set to magnitude d (d is a positive number) with the respectively fixed depth.

In this case, the slot 11 for light source arrangement of the light guide plate 10 concerning the gestalt of this operation shown in drawing 3 (a) guides the light by which incidence was carried out from a flat surface 11-1 and 11-2. that is, -- a flat surface -- 11 - one -- a cross section -- die length -- d -- ' ($d' > d$ and d' is a positive number) -- a flat surface -- 11 - two -- a cross section -- die length -- d -- " ($d'' > d$ and d'' is a positive number) -- having doubled -- magnitude ($d' + d''$) -- it is proportional -- an amount -- light -- guiding waves .

[0030]

The light guide plate 40 with which the cross-section configuration shown in drawing 3 (b) has the slot 41 for light source arrangement on rectangular guides the light by which incidence was carried out from a flat surface 41-1 and 41-2. That is, the light of the amount proportional to the magnitude of $2d$ which doubled die-length d of the cross section of a flat surface 41-1 and die-length d of the cross section of a flat surface 41-2 is guided.

Although the light guide plate 50 with which the cross-section configuration shown in drawing 3 (c) has the slot 51 for abbreviation hemicycle light source arrangement is based also on the refractive index of the ingredient to be used, and the refractive index of the optical outgoing radiation side 53 exterior, it guides the light by which incidence was carried out from the part of the arc of about 53 central angles shown by 51-1 and 51-2 all over drawing. That is, the light of the amount proportional to die length of about $1.84d$ which doubled die length of about $0.92d$ of the die length $2\pi dx53$ of the cross section of a field $51-1 / 360 = \text{about } 0.92d$, and the cross section of a field 51-2 is guided.

[0031]

Therefore, the magnitude of the amount of the light which each slot for light source arrangement guides serves as the about following relation.

Light guide plate 10 : $d' + d'' (> 2d)$

Light guide plate 40 : $2d$

Light guide plate 50 : $1.84d$

[0032]

as mentioned above, the light guide plate 40 with which a cross-section configuration has the slot 41 for light source arrangement of an abbreviation rectangle in the depth (height) as the slot 11 for light source arrangement with the light guide plate 10 same so that clearly concerning the gestalt of this operation -- moreover, the amount of the light which a cross-section configuration guides rather than the light guide plate 50 which has the slot 51 for light source arrangement of an abbreviation hemicycle in the same depth (height) as the slot 11 for light source arrangement increases.

[0033]

Thus, since the light guide plate 10 in the gestalt of this operation has much light which guides waves, the brightness of the abbreviation upper part (the field A in drawing 3 (a)) of the slot 11 for light source arrangement does not become remarkably high compared with other locations, therefore it crosses all over optical outgoing radiation side 13, and almost fixed brightness is obtained. That is, brightness unevenness can be lessened extremely.

[0034]

In addition, when at least one of the flat surfaces which constitute the slot 11 for light source arrangement is constituted so that the optical outgoing radiation side 13 and the include angle to make may turn into 40 or less degrees 25 degrees or more, since the amount of the light which guides waves can be made [many / very] and brightness unevenness can be made smaller, it is desirable.

Moreover, when it constitutes so that the include angle which makes all the flat surfaces that constitute the slot 11 for light source arrangement with the optical outgoing radiation side 13 may turn into 40 or less degrees 25 degrees or more, since the amount of the light which guides waves can be made [more / still] and brightness unevenness can be made very small, it is desirable.

[0035]

<Thickness of a light guide plate 10>

Moreover, as shown in drawing 4 (a), although a light guide plate 10 is based also on the light guide plate ingredient adopted as the upper part (thickness B) of the slots 11a and 11b for light source arrangement, the thickness of 1 to 2mm or more is usually needed. It is [this / two] mainly reasonable.

[0036]

A one-eyed reason is for making it make the light by which outgoing radiation was carried out from two or more cold cathode fluorescent lamps 18 arrive at any location of the optical outgoing radiation side 13.

If a certain amount of thickness (light guide plate) is in the upper part of slot 11a for light source arrangement as shown in drawing 4 (a), the light by which incidence was carried out from slot 11 for light source arrangement b will arrive at the opposite side or the slot 11a upper part with slot 11b of slot 11a. It arrives at 11a, the opposite side, and the upper part of optical fang furrow 11b which carried out incidence from 11a similarly. That is, since the optical outgoing radiation side 13 carries out outgoing radiation of the light from two or more cold cathode fluorescent lamps 18a and 18b on the whole surface mostly, the brightness of each point in the optical outgoing radiation side 13 is prescribed by the sum total of the quantity of light of two or more cold cathode fluorescent lamps 18a and 18b.

On the other hand, if the upper part of slot 11a for light source arrangement has little thickness (light guide plate) as shown in drawing 4 (b), the light by which incidence was carried out from slot 11 for light source arrangement b will hardly arrive at the opposite side or the slot 11a upper part with slot 11b of slot 11a. In the field between slot 11a for light source arrangement and edge 15a in drawing 4 (b), most light which arrives at the optical outgoing radiation side 13 will turn into only light from cold cathode fluorescent lamp 18a of 1. The light to which the light by which incidence was carried out from slot 11a does not arrive at the field between 11b and 15b similarly, but arrives at the optical outgoing radiation side 13 of this part will turn into only light of the cold cathode fluorescent lamp 18. That is, the part on the optical outgoing radiation side 13 where brightness is specified with the output of one cold cathode fluorescent lamp 18 exists.

[0037]

Therefore, when the output (quantity of light) of the cold cathode fluorescent lamp 18 of 1 differs from the set point, the effect which this has on brightness from the optical outgoing radiation side 13 can do smaller than the light guide plate which does not almost have thickness as shown in (b) the direction of the light guide plate which has a certain amount of thickness on slot 11a for light source arrangement as shown in drawing 4 (a). Moreover, although the outgoing radiation of the light can be carried out from any location of the optical outgoing radiation side 13 in the light guide plate shown in drawing 4 (a) when the cold cathode fluorescent lamp 18 of 1 has broken, the part which cannot carry out outgoing radiation of the light will be made in the light guide plate shown in (b).

[0038]

Thus, even if a certain cold cathode fluorescent lamp 18 breaks, in order that use may make it hard to become improper, a certain amount of thickness is needed [brightness unevenness is made hard to generate, and], even when the output of two or more cold cathode fluorescent lamps 18a and 18b becomes a thing different, respectively from the set point for the upper part of the slot 11 for light source arrangement.

[0039]

The second reason is that sufficient reinforcement is not obtained, when there is none of a certain amount of thickness.

Although a light guide plate is based on the ingredient to be used, it is because sufficient reinforcement as a product will not be obtained if there is generally no thickness of about 1-2mm or more.

[0040]

What is necessary is just to have a certain thickness at least for these reasons, although it is desirable if there is a certain amount of thickness in the upper part of the slot 11 for light source

arrangement. It is because the brightness of the slot upper part does not become high like the first conventional technique by this or the bright line does not arise. Moreover, since light by which a guided wave is carried out is made [many] as the slot 11 for light source arrangement which consists only of a slanting flat surface to an optical outgoing radiation side in the gestalt of this operation was adopted and described above, brightness homogeneity with the thickness of the light guide plate upper part sufficient at least is acquired.

[0041]

<Dispersion dot 12>

As shown in drawing 5, the dispersion dot 12 is a slot as a lighting means which enables it to exceed the critical angle in the optical outgoing radiation side 13 which changes the travelling direction (include angle) of the light L1 by which incidence was carried out (L1 →L2, L3 →L4), and is specified with the refractive index of a light guide plate 10, and an external refractive index. Many dispersion dots 12 are usually formed all over a tooth-back 14 side.

[0042]

<The light guide plate 10 creation approach>

A light guide plate 10 can be created by operating orthopedically in the above-mentioned configuration using the well-known creation approach which creates the light guide plate in the lighting system of an edge light method.

For example, tabular transparence or a tabular translucent substrate may be peeled off mechanically, and the slot 11 for light source arrangement and the dispersion dot 12 may be formed.

In tabular transparence or a tabular translucent substrate, it etches, after covering a mask over the location in which the slot 11 for light source arrangement and the dispersion dot 12 are not formed, and taking a mask after etching termination can also create.

Moreover, it can create also with injection molding which slushes and hardens the resin for light guide plate 10 formation in the mold of the slot 11 for light source arrangement, and the dispersion dot 12.

[0043]

<The quality of the material of a light guide plate 10>

The light guide plate 10 should just be formed from the optical outgoing radiation side 13 from the cold cathode fluorescent lamp 18 with transparence or a translucent ingredient to the light of the wavelength which carries out outgoing radiation among the light by which incidence was carried out. That is, what is necessary is just to be able to penetrate the light taken out from the optical outgoing radiation side 13. Generally, transparence or a translucent ingredient is chosen to the light (light with a wavelength of 380nm – about 780nm).

[0044]

As above ingredients, the ingredient used for the light guide plate of a side edge mold lighting system can also be chosen, for example, for example, a polycarbonate, amorphous polyolefine, etc. can be chosen.

Moreover, glass transition temperature has about 110 degrees and practically sufficient thermal resistance, a photoelastic coefficient and a birefringence are comparatively small, although there is little effect which the residual stress and flow-induced orientation at the time of molding have on the optical property of a cast, Izod impactive strength is comparatively small, and the polymethylmethacrylate which shows a brittle-like destructive property in comparison can be used. This is because a light guide plate 10 does not have an extremely thin part unlike the conventional technique of the above second (since it does not have an optical inclined plane).

[0045]

<Light reflex plate 19>

The part prepared in the abbreviation tooth back of the cold cathode fluorescent lamp 18 among the light reflex plates 19 reflects in a light guide plate 10 side the light (light which goes to the opposite side in a light guide plate 10) by which incidence is not carried out to a light guide plate 10 among the light emitted from the cold cathode fluorescent lamp 18, and it is made it to carry out incidence to a light guide plate 10. Therefore, since the utilization factor of the light emitted by the above-mentioned part from the cold cathode fluorescent lamp 18 compared with the case

where the light reflex plate 19 is not formed becomes high, the brightness of a lighting system 1 can be made high.

[0046]

Moreover, the part prepared in the abbreviation tooth back of a light guide plate 10 reflects in the exterior the light by which outgoing radiation was carried out from the tooth back 14 of a light guide plate 10 at a light guide plate 10 side, and it is made it to carry out incidence to a light guide plate 10. Therefore, since the amount of the light by which outgoing radiation is carried out to the above-mentioned part from the optical outgoing radiation side 13 of a light guide plate 10 outside compared with the case where the light reflex plate 19 is not formed increases, the brightness of a lighting system 1 can be made high.

[0047]

The plate which consisted of metal metallurgy group compounds, such as iron, aluminum, gold, and silver, may be used for the light reflex plate 19 that what is necessary is just to have the property to reflect the light by which incidence was carried out as mentioned above. White PET is also employable.

Next, the liquid crystal display component 2 is explained.

[0048]

<<liquid crystal display component 2>>

If the liquid crystal display component 2 is a liquid crystal display component of a transparency mold, any well-known component can be used for it. Generally, two or more pixels with which the liquid crystal matter was filled up are prepared between two glass substrates which separate the gap of about several micrometers and counter and with which the transparent electrode was prepared. If an electrical potential difference is applied to inter-electrode [each], the orientation condition of liquid crystal will change, and the condition (amount) of the light (passing light) by which incidence is carried out from a non-display side, and outgoing radiation is carried out from the screen is controlled by each pixel. This control is performed about each pixel and a pattern is displayed on the screen according to the difference of the amount of the light which passes each pixel. For example, a configuration as shown in drawing 6 is taken.

[0049]

The transparency mold liquid crystal display panel 2 shown in drawing 6 is arranged so that a transparent electrode 24 and 24' may counter [the substrate 23 with which a transparent electrode 24 and the orientation film 25 were formed, and this and substrate 23' of this configuration]. Among both, the spacer material 27 for making a gap into a suitable value is formed, and it fills up with the liquid crystal constituent 28. the periphery of a substrate 23 and 23' -- the liquid crystal constituent 28 -- a substrate 23 and 23' -- it limits inside and the sealant 26 for making it a foreign matter not mix in the interior is formed. A polarizing plate 29 and 29' are prepared in the substrate 23, the transparent electrode 24 in 23', and the field in which 24' is not prepared, respectively. The liquid crystal display component 2 equipped with the above configuration adjusts the amount of the light which it drives as described above by the well-known drive circuit, and incidence of the light from a lighting system 1 is carried out to the non-display side 22 side, and carries out outgoing radiation from the screen 21 for every pixel, and displays a pattern on the screen 21.

[0050]

<<effectiveness>>

Since the light guide plate 10, the lighting system 1, and liquid crystal display concerning the gestalt of this operation are equipped with the above configuration, they can acquire the following effectiveness.

(1) The brightness in locations other than right above [of the slot 11 for light source arrangement in the optical outgoing radiation side 13 / abbreviation] is high.

This is because the light which guides the inside of a light guide plate 10 increases more than the light guide plate with which the cross-section configuration was equipped with the slot for light source arrangement of a rectangle or a hemicycle since the slot 11 for light source arrangement consists of only slanting flat surfaces to the optical outgoing radiation side 13.

Moreover, it becomes possible to lose that the brightness of the abbreviation right above of the

slot 11 for light source arrangement in the optical outgoing radiation side 13 becomes very higher than the brightness of other locations, to have not ***** brightness unevenness very small enough and to carry out it as a result, by this.

[0051]

(2) There is little brightness unevenness compared with the lighting system of the direct female mold which does not use the conventional light guide plate.

This is a guided wave and because the light guide is carried out about the light by which incidence was carried out from the cold cathode fluorescent lamp 18.

Moreover, with a light guide plate, a guided wave and since the light guide is carried out, even if a complicated optical design does not design the configuration of a light reflex plate like before, it crosses all over an optical outgoing radiation side, and the light of the brightness of homogeneity is obtained mostly.

[0052]

(3) Even if thin-shape-izing is more possible than the conventional lighting system including the second conventional technique and it thin-shape-izes, sufficient reinforcement as a product is obtained.

It is because the light guide plate 10 which this requires for the gestalt of this operation has many amounts of the light to which the guided wave of the slot 11 for light source arrangement is constituted and carried out only at a slanting flat surface to the optical outgoing radiation side 13, so it is not necessary to establish an inclined plane in the upper part of the slot for light source arrangement like the second conventional technique. That is, in order to make thickness of a light guide plate 10 into reinforcement equivalent to the second conventional technique, even when thickness of the slot 11 upper part for light source arrangement is made into both identitas, it can do more thinly than the light guide plate by part for the depth of an inclined plane, and the second conventional technique, and very good brightness homogeneity is acquired.

[0053]

Moreover, even if it makes very thin thickness of the light guide plate 10 of the slot 11 upper part for light source arrangement, since the light guide plate 10 concerning the gestalt of this operation consists of only flat surfaces which are not perpendicular and parallel to the optical outgoing radiation side 13, there are many amounts of the light by which a guided wave is carried out, and very good brightness homogeneity is acquired.

[0054]

(4) Even if the output of the light source shifts from the set point, it is not conspicuous and brightness unevenness is made.

The light guide plate 10 which this requires for the gestalt of this operation is because light reaches from two or more cold cathode fluorescent lamps 18, so any part of an optical outgoing radiation side can reduce the effect even if the output of the cold cathode fluorescent lamp 18 has shifted from the design value since sufficient thickness for the upper part of the slot 11 for light source arrangement can be prepared as described above.

[0055]

(5) Compared with the liquid crystal display by the first conventional technique, the assembly of a liquid crystal display is easy.

It is because the liquid crystal display which this requires for the gestalt of this operation should just incorporate one light guide plate (one) unlike the first conventional technique. Moreover, thereby, it can perform very few that an optical property as the light guide plate was incorporated and designed in a different location from a design location is not obtained like the liquid crystal display by the first conventional technique.

[0056]

<<modification>>

In addition, the above-mentioned liquid crystal display, a lighting system, and a light guide plate can be changed suitably, for example, can also deform as follows. Moreover, it is also employable, combining the following modifications suitably.

[0057]

<Modification 1:wedge light guide plate>

The cross-section configuration of a light guide plate 10 may be made into the shape of a wedge.

For example, as shown in drawing 7 (a), the field between slot 11a for light source arrangement and end-face 15a of a light guide plate 10 may be made into the shape of a wedge to which the distance of a tooth back 14 and the optical outgoing radiation side 13 becomes short as 15d of end faces is approached from slot 11 for light source arrangement a. As shown in (b), the field between slot 11a for light source arrangement and end-face 15a and the field between slot 11b for light source arrangement and 15d of end faces may be made into the shape of a wedge. As shown in (c), some fields between the slot 11 for light source arrangement and an end face 15 may be made into the shape of a wedge.

[0058]

moreover, the brake-shoe type configuration (configuration where the shape of two wedge was doubled) where the distance of a tooth back 15 and the optical outgoing radiation side 14 becomes short as are shown in drawing 8 (a) and the location C of arbitration is approached in the field between the slots 11a and 11b for light source arrangement -- even if -- it is good. Naturally, as shown in drawing 8 (b), the field between the field between the slot 11 for light source arrangement and an end face 15 and slot 11a for light source arrangement, and slot 11b for light source arrangement may be made into the shape of a wedge.

[0059]

The include angle (incident angle) light carries out [an include angle] incidence to the optical outgoing radiation side 13 or a tooth back 14 becomes small as it will keep away from the cold cathode fluorescent lamp 18 which is the light source, if the shape of a wedge is adopted as mentioned above. Since light which carries out outgoing radiation from an end face 15 to the exterior, and light which is reflected by the end face 15, is confined in the light guide plate 10 interior, and disappears can be lessened by this and the rate of the light (light within a critical angle) in which outgoing radiation is possible increases from the optical outgoing radiation side 13 to the exterior, the rate of optical outgoing radiation and efficiency for light utilization improve rather than a rectangular light guide plate.

[0060]

In addition, as shown in drawing 7 (a), the include angle sigma which the tooth back 14 to the optical outgoing radiation side 13 makes is set as 10 or less degrees exceeding 0 times, and is usually preferably set as 1 or less time 0.2 degrees or more. If set as such an include angle, fetch effectiveness of light can be made very high, and it will cross to the optical outgoing radiation side 13, and the outgoing radiation of the light of the brightness of homogeneity can be carried out mostly.

[0061]

Moreover, even if the tooth back 14 consists of curved surfaces in the field to which a tooth back 14 approaches the optical outgoing radiation side 13 as the optical outgoing radiation side 13 and a tooth back 14 may not be flat surfaces, for example, are shown in drawing 9 (a), and end faces 15a and 15d are approached from the slot 11 for light source arrangement, the effectiveness of the above-mentioned EQC is acquired. Moreover, even if the tooth back consists of curved surfaces in the field to which a tooth back 14 approaches the optical outgoing radiation side 13 as are shown in (b), and the point C of arbitration is approached from the slot 11 for light source arrangement, the effectiveness of the above-mentioned EQC is acquired.

[0062]

<The shape of a modification 2:quirk>

Since the slot for light source arrangement should just consist of slanting flat surfaces to the optical outgoing radiation side, naturally it may consist of three or more flat surfaces. Thus, if constituted from two or more flat surfaces, since [which receives the number of plane, and the optical outgoing radiation side of each flat surface] it is suitable (include angle) and the area (the die length of the side in a cross section) of each flat surface can adjust, the degree of freedom of an optical design will increase the amount of the light made to reach to the amount of the direction which guides the light by which incidence was carried out, and the light which

guides waves, and the right above section of the slot for light source arrangement etc.

[0063]

Moreover, if a cross-section configuration which wraps in the cold cathode fluorescent lamp 18 according to the flat surface which constitutes the slot 11 for light source arrangement is adopted as shown in the sectional view of drawing 10, the depth of flute can be made shallow and thin-shape-izing and lightweight-izing of a light guide plate, a lighting system, and a liquid crystal display will also become possible.

[0064]

<modification 3: Beveling>

Beveling processing of the angle which the flat surfaces which constitute the slot for light source arrangement make may be carried out. For example, as shown in the sectional view of drawing 11 (a), even if linear, it is good, and the cross-section configuration of angle 16 may be rounded off as shown in (b). Moreover, it is good even if notched in a cross-section configuration, as shown in (c).

Thus, if angle 16 is processed, as shown in drawing 12, light from the cold cathode fluorescent lamp 18 which carries out incidence into a light guide plate through angle 16 (introduced) can be made [more] than the case where angle 16 is not processed. Consequently, the degree of freedom of an optical design goes up, and the brightness of each location in an optical outgoing radiation side can be fixed easy mostly.

[0065]

<The number of the slots for modification 4:light source arrangement, the location to arrange>

The number of the slots for light source arrangement and the number of the light sources can be suitably set up according to the brightness needed as a lighting system. The location which forms the slot for light source arrangement can also be set up suitably.

Therefore, the gestalt of this operation is employable suitable also for a large-sized lighting system. Moreover, the display with the clear large-sized liquid crystal display equipped with this lighting system as a back light is attained.

[0066]

<modification 5: Light source>

As the light source, the well-known light source is employable. For example, a hot cathode fluorescent lamp can also be used instead of a cold cathode fluorescent lamp.

moreover, when using light emitting diode, it is good for Mizouchi for light source arrangement to arrange two or more light emitting diodes so that it is alike and may be shown.

Field-like spontaneous light corpuscle children, such as an organic electroluminescent element and an inorganic electroluminescent element, can also be used as the light source. If it arranges the field-like spontaneous light corpuscle child 18-1 and 18-2 along the flat surface which constitutes the slot 11 for light source arrangement as shown in drawing 13 in using a field-like spontaneous light corpuscle child, the amount which incorporates a component 18-1 and the light emitted from 18-2 to a light guide plate 10 can be made [many].

[0067]

<A modification 6:optical member is prepared.>

As shown in drawing 14, the optical member 8 may be formed between a lighting system 1 and the liquid crystal display component 2. As an optical member 8, a diffusion sheet, a prism sheet, etc. which are adopted as the lighting system of a side edge mold can use the well-known member to which the property and travelling direction of light are changed.

For example, if a diffusion sheet (diffusion member) is prepared, the light by which outgoing radiation was carried out from the optical outgoing radiation side of a light guide plate will be diffused, and incidence can be carried out to a liquid crystal display component. The brightness of the light which carries out incidence to a liquid crystal display component can be made more into homogeneity by this, or an angle of visibility can also be made large.

Moreover, if the refraction mold prism sheet (refraction mold prism member) and total reflection mold prism sheet (total reflection mold prism member) which were set up so that the brightness of the light of the direction of a normal in the non-display side of a liquid crystal display component might become the highest are used, the amount of the light by which incidence is

carried out to a liquid crystal display component can be made [many].

Naturally, it can also use combining two or more congener or optical members of a different kind.

[0068]

<Deformation of the modification 7:light reflex plate 19, an abbreviation>

In the gestalt of the above-mentioned implementation, although the tabular light reflex plate 19 is formed in the tooth-back side of a light guide plate 10 and the cold cathode fluorescent lamp 18, the configuration and magnitude of the light reflex plate 19 can be changed suitably, and the light reflex plate 19 can also be omitted.

[0069]

For example, as shown in drawing 15 (a), the light reflex plate 19-1 may be formed only in the abbreviation tooth-back side of the cold cathode fluorescent lamp 18. Also by this configuration, since incidence of the light by which outgoing radiation was carried out from the cold cathode fluorescent lamp 18 to the tooth-back side can be carried out to a light guide plate 10, compared with the case where the light reflex plate 19-1 is not formed, the utilization factor of the light by which outgoing radiation was carried out from the cold cathode fluorescent lamp 18 becomes high, and can make the brightness of a lighting system 1 high.

[0070]

As shown in drawing 15 (b), the light reflex plate 19-2 may be formed only in the part in which the slot 11 for light source arrangement is not established in the tooth-back 14 side of a light guide plate 10. Also by this configuration, since the light by which outgoing radiation was carried out from the light guide plate 10 tooth-back side 14 can be returned to the interior of a light guide plate, compared with the case where the light reflex plate 19-2 is not formed, the brightness of a lighting system 1 can be made high.

[0071]

As shown in drawing 15 (c), the light reflex plate 19-3 may be formed also in the end face 15 of a light guide plate 10. If this configuration is adopted, the light by which outgoing radiation will be carried out can be returned to the exterior in a light guide plate from the end face 15 of a light guide plate 10, and the brightness of a lighting system 1 can be made high compared with the case where the light reflex plate 19-3 is not formed.

[0072]

If a light guide plate 10 and the cold cathode fluorescent lamp 18 are covered with the light reflex plate 19-4 in a lighting system 1 so that only the optical outgoing radiation side 13 may be outside exposed as shown in drawing 16 (a), since the amount of the light by which outgoing radiation is carried out from other than optical outgoing radiation side 13 in the lighting-system 1 exterior can be lessened extremely, the brightness of a lighting system 1 becomes very high.

[0073]

As shown in drawing 16 (b), it is good not to reflect in a lamp 18 side the light by which incidence was carried out from the cold cathode fluorescent lamp 18 in the configuration of the light reflex plate 19-5 in the part in which the slot 11 for light source arrangement is not established in the tooth-back side of a light guide plate 10, but to design the light by which incidence was carried out in the configuration which carries out incidence to a light guide plate 10. By making it such a configuration, it reflects with a light reflex plate, incidence is carried out to the cold cathode fluorescent lamp 18, and light which declines and disappears in the lamp 18 interior can be lessened.

[0074]

The light reflex plate 19-6 in the part in which the slot 11 for light source arrangement is not established in the tooth-back side of a light guide plate 10 may be made to touch a light guide plate 10, as shown in drawing 16 (c). Moreover, the ingredient which has light reflex engine performance, such as a metal, for the light reflex plate 19-6 in this part in a light guide plate 10 may be made to vapor-deposit, and you may form.

[0075]

<Modification 8:lighting means>

A lighting means is employable no matter it may be what thing, if it is the lighting means adopted

as a well-known light guide plate. For example, as shown in drawing 17 (a), the dispersion dot 12 may be formed in the optical outgoing radiation side 13 side, and as shown in drawing 17 (b), you may prepare in the optical outgoing radiation side 13 and tooth-back 14 both sides. Moreover, V mold groove and a serration mold groove may be used as a dispersion means.

Moreover, since the light guide plate 10 concerning the gestalt of this operation has the slot 11 for light source arrangement which consisted of only slanting flat surfaces to the optical outgoing radiation side 13, it does not need to establish a lighting means.

[0076]

<A modification, others>

In addition, it can also deform as follows.

- As shown in drawing 18, prepare 18g of light sources also in the end face 15 of a light guide plate 10.

Thereby, since the light of much more amounts can be introduced into a light guide plate 10 rather than the above-mentioned gestalt, the brightness of a lighting system 1 becomes higher.

- As shown in the perspective view of drawing 19, form the optical electric shielding section 9. In the optical outgoing radiation side 13, if the member which covers light by print processes etc. into a part with brightness higher than other locations is prepared, brightness will be made to homogeneity.

- A lighting system 1 can also be used in addition to the back light of the liquid crystal display component 2.

- A transfective type liquid crystal display component well-known as a liquid crystal display component is also employable.

[0077]

<<example>>

Although the example concerning this invention is described below, as for this invention, it is natural to limit to the following publications and not to be interpreted.

[0078]

<Example 1>

In the example 1, as shown in drawing 20, the slot 11 for light source arrangement which has the cross-section configuration of an isosceles triangle where the include angle to the optical outgoing radiation side 13 is 36.5 degrees, respectively, in a depth of 3mm and the distance of 4.4mm of a base in one field was established in the acrylic board with the thickness of 5mm, a width of face [of 160mm], and a die length (the die length of the longitudinal direction of a light guide plate cross section) of 98mm three tooth-back side 14. 11d of slots for light source arrangement has been arranged so that 16d of angles may take the lead (location of an end face to 49mm) in the longitudinal direction of a light guide plate cross section, and other slots 11c and 11e were formed so that angles 16c and 16e might be located in the location of 16.35mm from end faces 15a and 15d, respectively.

[0079]

as the field between the slots 11c and 11d for light source arrangement and the field between 11d and 11e approach the equidistant locations calcium and Cb (respectively from end faces 15a and 15b location of 32.68mm) from both slots, respectively -- the optical outgoing radiation side 13 and a tooth back 14 -- being linear (linear) -- it approached, and it designed so that the thickness of the light guide plate 10 in the above-mentioned location might be set to 1mm. Moreover, the optical outgoing radiation side 13 and the tooth back 14 approached linearly, respectively as the end face 15 was approached from the slot 11 for light source arrangement, and the field between slot 11c for light source arrangement and end-face 15a and the field between slot 11e and 15d of end faces were designed so that the thickness of an end face 15 might be set to 1mm.

[0080]

In each slot 11 for light source arrangement, it has arranged so that the core of a circle may come to the vertical bottom of angle 16 in the cross section which shows the cold cathode fluorescent lamp 18 of the shape of a cylinder with a radius of 1.5mm which outputs the light of tales doses, respectively to drawing 20.

[0081]

In the above-mentioned lighting system 1, the brightness in the location F in the optical outgoing radiation side 13 (location of end-face 15a to 32.68mm) was computed by the ray-tracing simulation by the Monte Carlo method. The brightness obtained by this simulation was made into the reference value 1. A result is shown in the following table 1.

[0082]

<The example 1 of a comparison>

In the example 1 of a comparison, in the sectional view shown in drawing 21, the slot 41 for light source arrangement was made into height (length) of 3mm, and die length of 6mm of a longitudinal direction (an equivalent for width and a base), and the lighting system 4 was designed like the example 1 except having made it the core 46 of the die length of a longitudinal direction become the location of the angle 16 of the slot 11 for light source arrangement in an example 1.

[0083]

The brightness of the point [in / for the designed lighting system 4 / the optical outgoing radiation side 43] F was measured on an example 1 and these conditions. The magnitude of the brightness when making the brightness in an example 1 into criteria (1) is shown in the following table 1.

[0084]

<The example 2 of a comparison>

In the example 2 of a comparison, in the sectional view shown in drawing 22, as the right above section 56 of the core of a semicircle became the location of the angle 16 of the slot 11 for light source arrangement in an example 1, except that the radius of the slot 51 for light source arrangement was set to 3mm, and the cross-section configuration made it the slot 51 for light source arrangement on the hemicycle, the lighting system 5 was designed like the example 1.

[0085]

The brightness of the point [in / for the designed lighting system 5 / the optical outgoing radiation side 53] F was measured on an example 1 and these conditions. The magnitude of the brightness when making the brightness in an example 1 into criteria (1) is shown in the following table 1.

[0086]

<Examples 2-12>

In the examples 2-12, set the height of the slot 11 for light source arrangement to 3mm, and the include angle to an optical outgoing radiation side, respectively 20 degrees, 22.5 degrees, 25 degrees, 27.5 degrees, 30 degrees, 32.5 degrees, 35 degrees, 37.5 degrees, It has the cross-section configuration of the isosceles triangle of 40 degrees, 42.5 degrees, and 45 degrees, and the lighting system 1 was designed like the example 1 except having made it the angle 16 of each slot become the location of the angle 16 of the slot 11 for light source arrangement in an example 1.

[0087]

The brightness of the point [in / for the lighting system designed, respectively / an optical outgoing radiation side] F was measured like the example 1. The magnitude of the brightness when making the brightness in an example 1 into criteria (1) is shown in the following table 1.

[0088]

[Table 1]

	平面の角度 (度)	輝度 (実施例 1 を基準 = 1)
実施例 1	36.5	1
比較例 1	90	0.80
比較例 2	(曲面、断面形状半円)	0.79
実施例 2	20	0.70
実施例 3	22.5	0.73
実施例 4	25	0.81
実施例 5	27.5	0.87
実施例 6	30	0.90
実施例 7	32.5	0.95
実施例 8	35	1.00
実施例 9	37.5	0.88
実施例 10	40	0.80
実施例 11	42.5	0.75
実施例 12	45	0.70

[0089]

<Evaluation>

The above-mentioned examples 1-12 and the examples 1-2 of a comparison showed the following things.

[0090]

(a) The brightness in the point F in the lighting system by the example 1 equipped with the slot for light source arrangement which consists only of two slanting flat surfaces to an optical outgoing radiation side was understood that a cross-section configuration is 1.25 times as high as the brightness in the point F in the lighting system by the rectangular example 1 of a comparison so that clearly from an example 1 and the example 1 of a comparison. That is, the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side was understood that the lighting system 1 in an example is more expensive.

[0091]

(b) The brightness in the point F in an example 1 was understood that a cross-section configuration is 1.26 times as high as the brightness in the point F in the lighting system by the example 2 of a comparison of a hemicycle so that clearly from an example 1 and the example 2 of a comparison. That is, the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side was understood that the lighting system 1 in an example is more expensive.

[0092]

(c) When it had the slot for light source arrangement which consists only of a slanting flat surface to an optical outgoing radiation side so that clearly from examples 1-12, it turned out that sufficient brightness is obtained also in locations other than the slot right above section for light source arrangement in an optical outgoing radiation side. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is the lighting system of the examples 1-2 of a comparison, and more than an EQC.

[0093]

(d) It turned out that brightness [in / slot / equipped with the flat surface of the include angle

which does not exceed 42.5 degrees more than 22.5 degrees to an optical outgoing radiation side / for light source arrangement / in a cross-section configuration / the point F of a rectangle or the circular slot for light source arrangement] is more than an EQC so that clearly from an example 1, examples 3-11, and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is the lighting system of the examples 1-2 of a comparison, and more than an EQC.

[0094]

(e) It turned out that brightness [in / slot / which was equipped with the flat surface of the include angle of 40 or less degrees 25 degrees or more to the optical outgoing radiation side / for light source arrangement / in a cross-section configuration / the point F of a rectangle or the circular slot for light source arrangement] is more than an EQC so that clearly from an example 1, examples 4-10, and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is the lighting system of the examples 1-2 of a comparison, and more than an EQC.

[0095]

(g) The slot for light source arrangement equipped with the flat surface of the include angle which does not exceed 40 degrees more than 22.5 degrees to an optical outgoing radiation side was understood that brightness [in / in a cross-section configuration / Point F] is higher than a rectangle and the circular slot for light source arrangement so that clearly from an example 1, examples 3-10, and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is higher than the lighting system of the examples 1-2 of a comparison.

[0096]

(h) The slot for light source arrangement equipped with the flat surface of the include angle of 37.5 or less degrees 25 degrees or more to the optical outgoing radiation side was understood that brightness [in / in a cross-section configuration / Point F] is higher than a rectangle and the circular slot for light source arrangement so that clearly from an example 1, examples 4-9, and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is higher than the lighting system of the examples 1-2 of a comparison.

[0097]

(i) The slot for light source arrangement equipped with the flat surface of the include angle of 37.5 or less degrees 27.5 degrees or more to the optical outgoing radiation side was understood that brightness [in / in a cross-section configuration / Point F] is higher than a rectangle and the circular slot for light source arrangement 1.08 or more times so that clearly from examples 5-9 and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is very higher than the lighting system in the example of a comparison.

[0098]

(j) The slot for light source arrangement equipped with the flat surface of the include angle which does not exceed 37.5 degrees more than 27.5 degrees to an optical outgoing radiation side was understood that brightness [in / in a cross-section configuration / Point F] is higher than a rectangle and the circular slot for light source arrangement 1.12 or more times so that clearly from examples 5-9 and the examples 1-2 of a comparison. That is, it turned out that the brightness of locations other than the slot right above section for light source arrangement in an optical outgoing radiation side is high [the lighting system in an example / especially].

[0099]

[Effect of the Invention]

According to this invention, the brightness of the optical whole outgoing radiation side (effective screen) surface can be mostly made into homogeneity so that clearly also from the above explanation.

Unlike the second conventional technique indicated by the patent reference 1, since there is no

extremely thin part in a light guide plate, the selectivity of an ingredient becomes high.

Since it cannot be necessary to make shallow the depth of flute for light source arrangement or and it is not necessary to prepare the inclined plane for internal reflection, thin-shape-izing and lightweight-izing of a lighting system or a liquid crystal display are attained.

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the liquid crystal display concerning the gestalt of this operation.

[Drawing 2] It is drawing having shown the light guide plate concerning the gestalt of this operation.

[Drawing 3] It is drawing for explaining the mechanism of the lighting system concerning the gestalt of this operation.

[Drawing 4] It is drawing for explaining the suitable example of a configuration of the light guide plate concerning the gestalt of this operation.

[Drawing 5] It is drawing 2 for explaining the mechanism of the lighting system concerning the gestalt of this operation.

[Drawing 6] It is a sectional view for explaining the configuration of the liquid crystal display component concerning the gestalt of this operation.

[Drawing 7] It is a sectional view for explaining the modification of the light guide plate configuration concerning the gestalt of this operation.

[Drawing 8] It is the second sectional view for explaining the modification of the light guide plate configuration concerning the gestalt of this operation.

[Drawing 9] It is the third sectional view for explaining the modification of the light guide plate configuration concerning the gestalt of this operation.

[Drawing 10] It is a sectional view for explaining the modification of the shape of a quirk for light source arrangement of the light guide plate concerning the gestalt of this operation.

[Drawing 11] It is the second sectional view for explaining the modification of the shape of a quirk for light source arrangement of the light guide plate concerning the gestalt of this operation.

[Drawing 12] It is the third sectional view for explaining the modification of the shape of a quirk for light source arrangement of the light guide plate concerning the gestalt of this operation.

[Drawing 13] It is a sectional view for explaining the modification of the lighting system concerning the gestalt of this operation.

[Drawing 14] It is a sectional view for explaining the modification of the lighting system concerning the gestalt of this operation, and a liquid crystal display component.

[Drawing 15] It is the second sectional view for explaining the modification of the lighting system concerning the gestalt of this operation.

[Drawing 16] It is the second sectional view for explaining the modification of the lighting system concerning the gestalt of this operation.

[Drawing 17] It is a sectional view for explaining the modification of the light guide plate concerning the gestalt of this operation.

[Drawing 18] It is the third sectional view for explaining the modification of the lighting system concerning the gestalt of this operation.

[Drawing 19] It is a sectional view for explaining the modification of the light guide plate concerning the gestalt of this operation, and a lighting system.

[Drawing 20] It is the sectional view having shown the light guide plate configuration of an example 1.

[Drawing 21] It is the sectional view having shown the light guide plate configuration of the example 1 of a comparison.

[Drawing 22] It is the sectional view having shown the light guide plate configuration of the example 2 of a comparison.

[Drawing 23] It is a sectional view for explaining the lighting system of the conventional edge light method.

[Drawing 24] It is a front view for explaining the lighting system of the conventional edge light method.

[Drawing 25] It is a sectional view for explaining the lighting system of the conventional direct female mold.

[Drawing 26] It is a sectional view for explaining the lighting system concerning the first conventional technique.

[Drawing 27] It is a sectional view for explaining the liquid crystal display concerning the second conventional technique.

[Description of Notations]

1 Lighting System

10 Light Guide Plate

11 Slot for Light Source Arrangement

12 Lighting Means

13 Optical Outgoing Radiation Side

14 Tooth Back

15 End Face

16 Angle Which Flat Surfaces Which Constitute Slot for Light Source Arrangement Make (Line)

[Translation done.]